SFJAR
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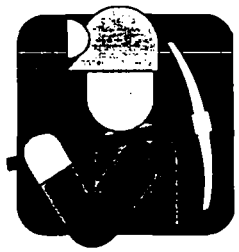


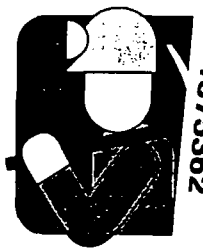
Cost/Benefit Analysis
Surface Water Diversions
Bunker Hill Mine Water Project

Presented by

Matt Germon/CH2M HILL

Jim Stefanoff /CH2M HILL

CH2MHILL



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March 3, 1999

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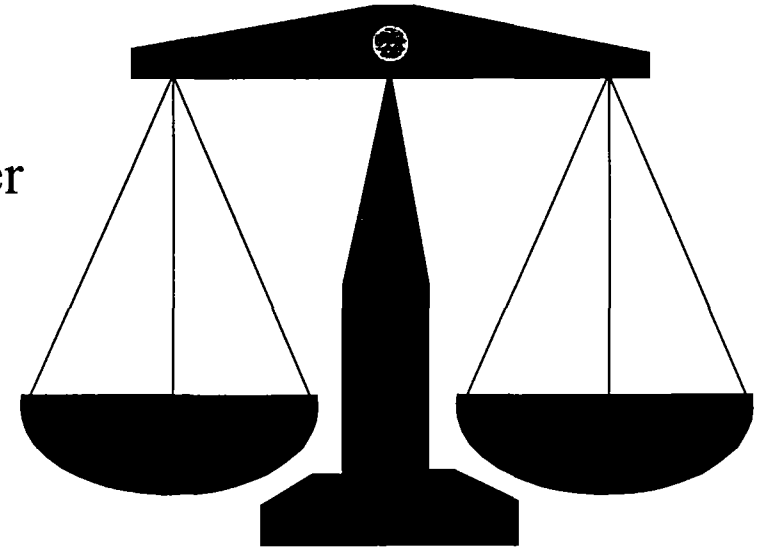
Purpose & Objective

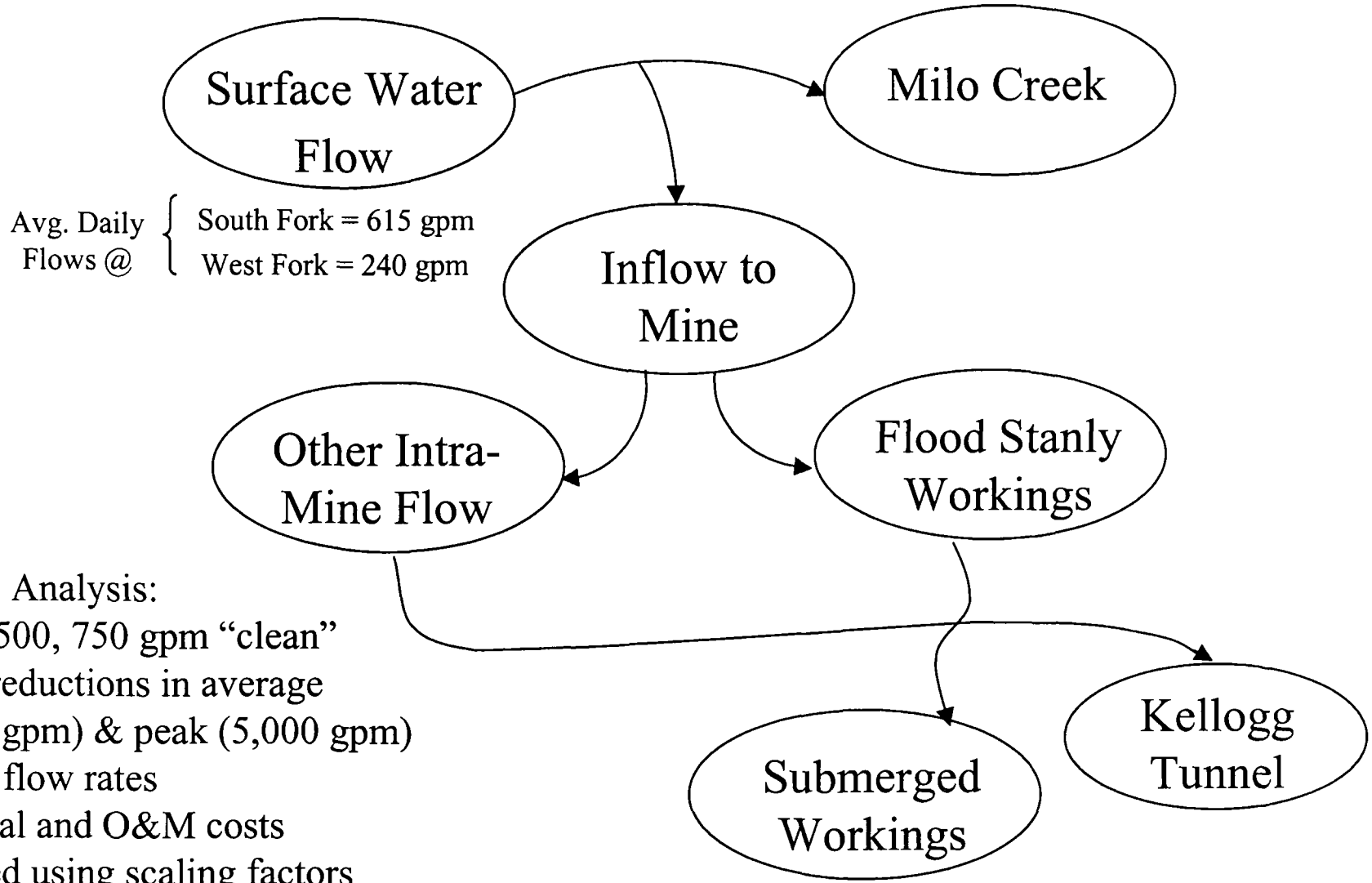
Surface Water Diversions



AMD Treatment Savings

- Not focused on AMD collection, conveyance & storage, or sludge management.

Methodology



TIER I Analysis:
- 250, 500, 750 gpm "clean" water reductions in average (1,500 gpm) & peak (5,000 gpm) design flow rates
- Capital and O&M costs adjusted using scaling factors

TABLE 2

Cost Summary of the West and South Fork Milo Creek Diversions

Costs are Order-of-Magnitude

Diversion	Estimated Capital Cost	Estimated O&M Cost ($/year)	Estimated Net Present Value (30 Years, 5% Interest)
South Fork Milo Creek	$720,000	$9,700	$870,000
West Fork Milo Creek	$1,060,000	$10,800	$1,230,000
Totals	**$1,780,000**	**$20,500**	**$2,100,000**

Figure 1
Savings in Treatment Capital Cost Resulting from a Decrease in Peak Design Treatment Rate

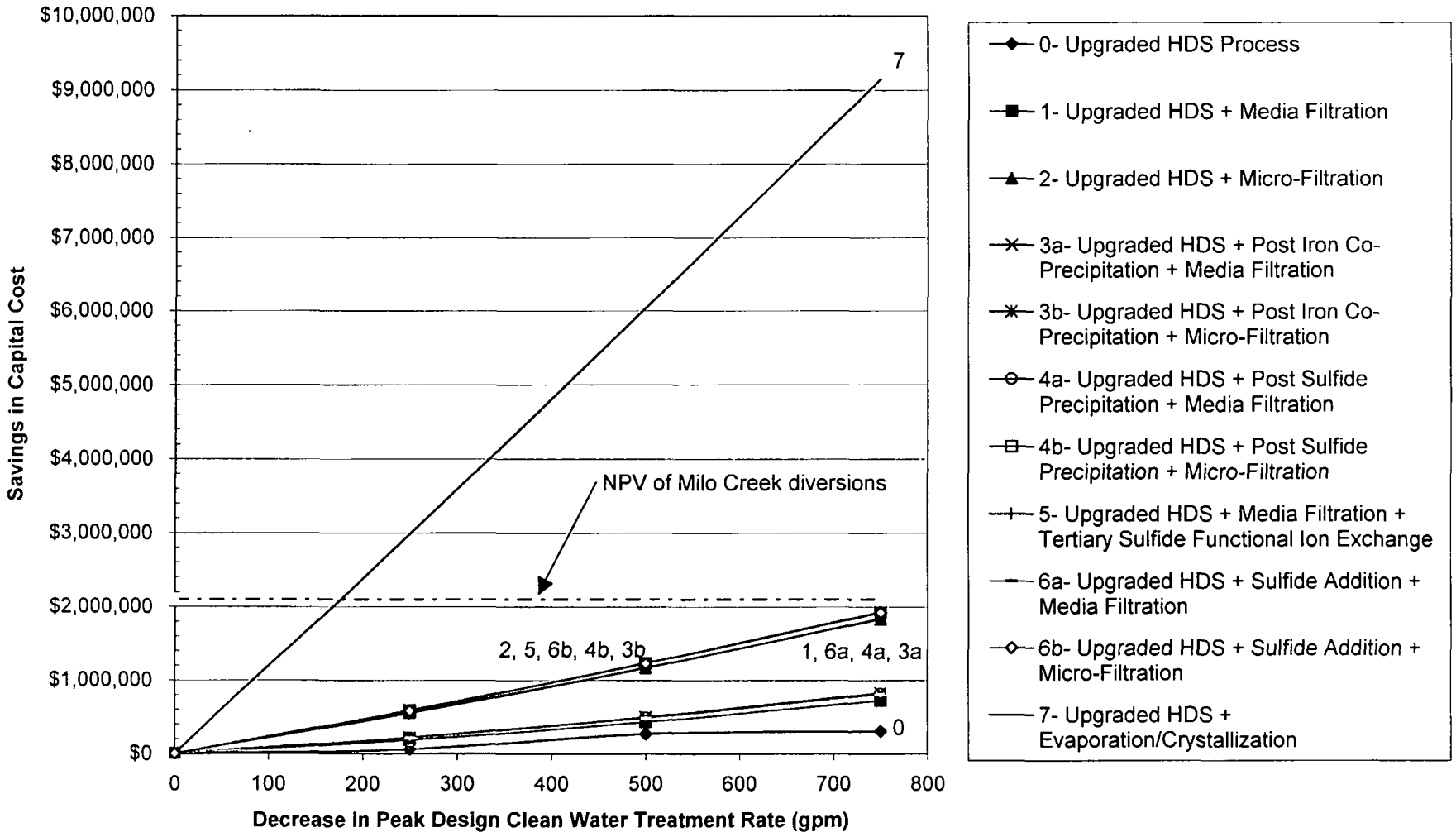


Figure 2
Savings in Treatment O&M NPV Resulting from a Decrease in Average Treatment Rate

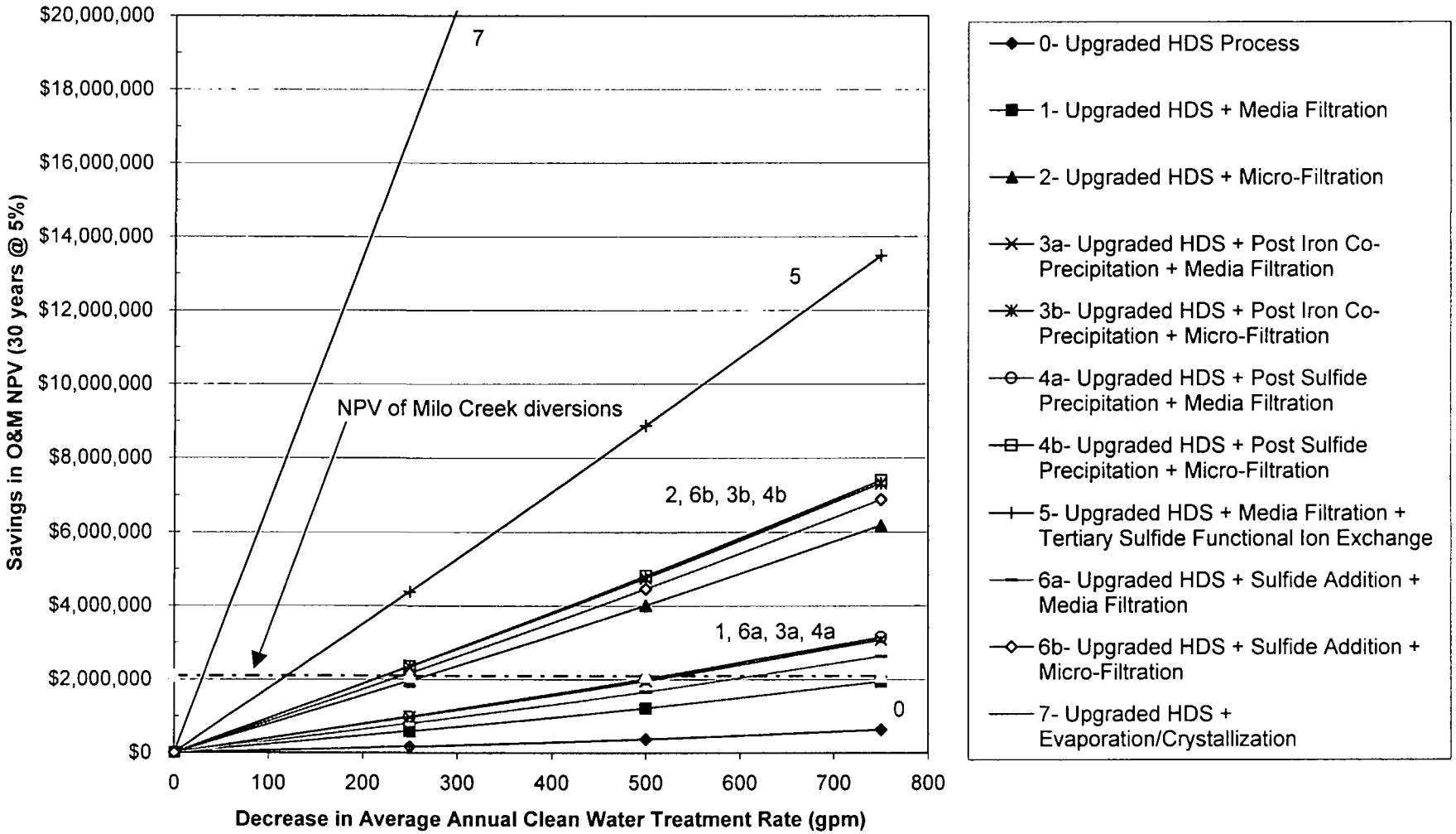


Figure 3
Savings in Total Treatment NPV (Capital and O&M) Resulting from a Decrease in Peak and Average Treatment Rate

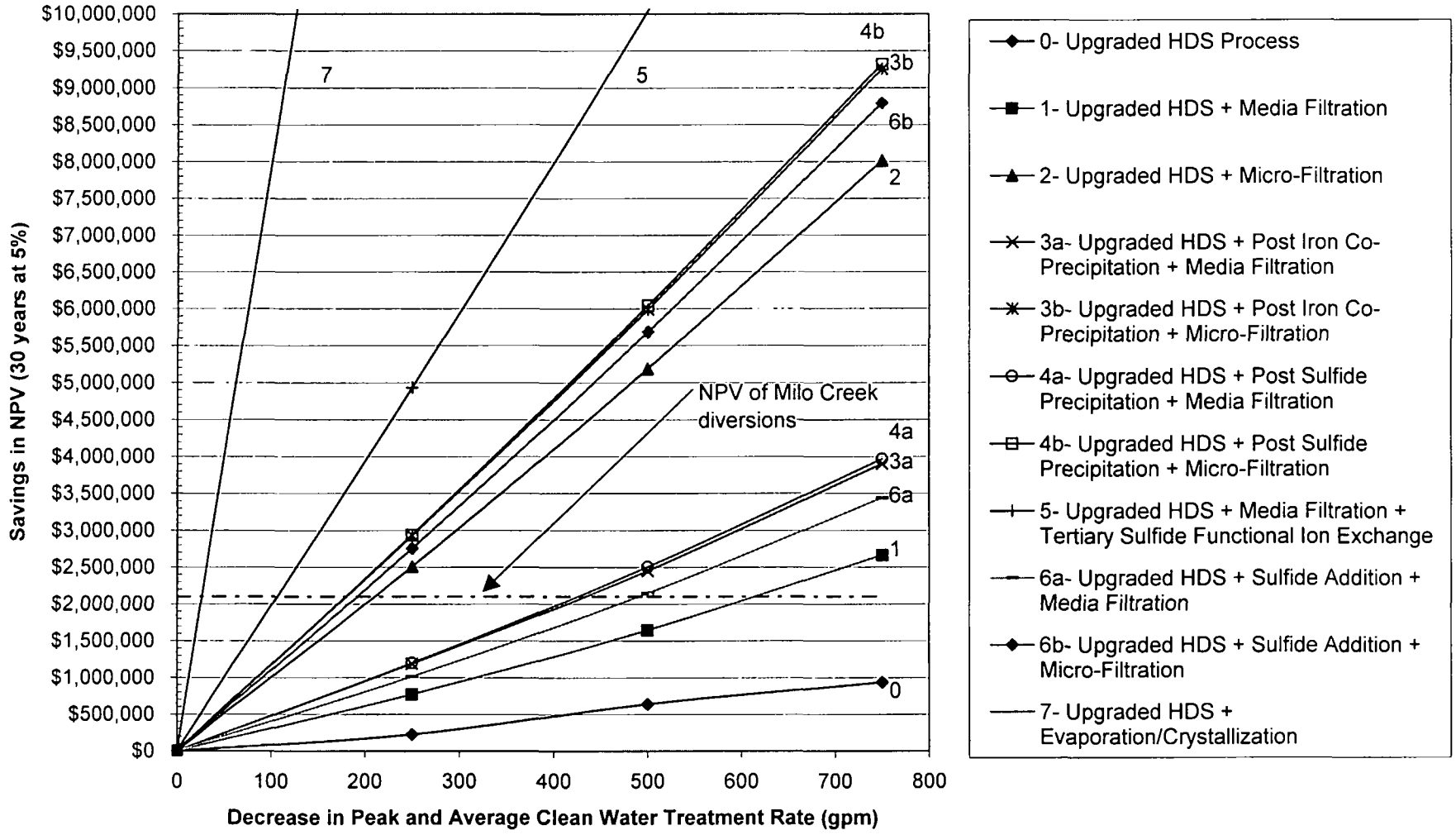


TABLE 3
Summary of Results

Minimum Reduction in Peak and Average Treatment Flow Required to Offset Diversion Costs	Treatment Option
>750 gpm	0- Upgraded HDS Process
600 gpm	1- Upgraded HDS plus Media Filtration
500 gpm	6a- Upgraded HDS plus Sulfide Addition plus Media Filtration
420 gpm	3a- Upgraded HDS plus Post Iron Co-precipitation plus Media Filtration
420 gpm	4a- Upgraded HDS plus Post Sulfide Precipitation plus Media Filtration
210 gpm	2- Upgraded HDS plus Micro-filtration
190 gpm	6b- Upgraded HDS plus Sulfide Addition plus Micro-Filtration
180 gpm	3b- Upgraded HDS plus Post Iron Co-precipitation plus Micro-Filtration
170 gpm	4b- Upgraded HDS plus Post Sulfide Precipitation plus Micro-Filtration
100 gpm	5- Upgraded HDS plus Media Filtration plus Tertiary Sulfide Functional Ion Exchange
25 gpm	7- Upgraded HDS plus Evaporation and Crystallization

Conclusions

- Savings in treatment cost > diversion cost for most treatment alternatives
- Based on "clean" water reductions:

  Reducing 1% acid & metal load = $140,000 (30-yr NPV)
- Additional benefits:
  - Reduction in AMD collection system maintenance
  - Increase in AMD storage time in lined pond or lower workings

Recommendations

- Implement West Fork and South Fork diversions if upgraded HDS or more rigorous processes are selected.
- Conduct hydrologic analysis to refine peak and average design flow rates with respect to TMDLs and river flow.
- Conduct C/B Analysis for Deadwood/Inez diversion.
- Flood-Stanly Workings Evaluation.